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The Obstacles of NFC Mobile Payment Development in Finland

Security Issues of NFC Mobile Payment

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ABSTRACT

In the recent years, with the rapid development of science and technology in the consumer markets, payment terms are being promoted much faster than ever. It is considered that NFC Mobile payment will enjoy a great prospect. NFC Mobile payment technique, which is based on the RFID technology, has been growing in popularity.

Near Field Communication (NFC) is the proximity standard for the proximity cards that can be modified to allow integration of the technology into a cellular phone. NFC technique can therefore be used to replace key cards and credit cards such as Visa and MasterCard. Moreover, the most popular payment function in Finland is magnetic card consumption.

The main objective of this research is to provide a clear view of NFC Mobile payment in Finland. Data was collected by an interview and through observation.

Key words: NFC technique, mobile payment, financial service, security issues, RFID.

1 INTRODUCTION

Nowadays, new technologies constantly affect the current market, consumption and daily life. Humans live a digitalized. (Wheadon, 2013)

Near Field Communication (NFC) technique refers to a short-range wireless communication technology, which enables data transfer, pay for retail transactions and connection between two devices by closely touching. (Forum, 2014) This paper focuses on the contactless mobile payment system. The main objective of the research is around the case study of what kind of factors are preventing NFC mobile payment technology utilized in Finland.

In the recent years, the trend of NFC technique has been growing in Finland. All Kesko Group stores have modern chip and pin payment terminals with the contactless acceptance symbol on the side indicating that the terminal contains near field communication technology. (Andelin, 2012)

Mobile phones are not just communication tools. Through their mobile phones human beings can do many things, take photographs, share information, use a GPS system, and use mobile banking systems and so on. In Finland, magnetic stripe card payment is widely used and using bank cards have become a part of people's everyday life. (Öörni, 2010)

Heikki Kapanen, CEO of Nets Oy, explains this: "Finland is a leader in card payments in Europe, it is only natural that we are a front-runner in developing new payment solutions. Finland has the high expectations of contactless payments and makes it as a wonderful opportunity for the future. (Clark, 2009)

In the following chapters the author will only observe the security issues, which prevents the NFC mobile payment developing in Finland though many other factors existed-should be acknowledged such as the data transferring speed, distance of touching and compatibility are still need be promoted, but space lacks for a detailed description of them. In order to deeply support the research, the

author make interview and give further analysis for the result of NFC mobile payment implementation in Finland.

2 RESEARCH APPROACH

2.1 Research Background

Mobile payment is expected to become one of the most important applications in mobile commerce. (Varshney, 2002) Mobile payments could be categorized based on the technology used as either one of two types Proximity Payment or remote. Proximity payment generally refers to contactless payment. (ISACA, 2011)

Finnish town Oulu is the technological innovation city. There are plenty of innovation programmes access public needs as the goal. There are new products and new services include the Smart Touch, which is based on the Near Field Communication technology to improve community services. However, even there is quite much trails take place in different application areas such as car parking, healthcare, and bus ticket service, still did not see many but few applications about this technology in Finland in payment section. Especially NFC mobile payment is rarely being seen in people's consuming life.

2.2 Research Question

Under this background the author focuses on the security issues, which might be the obstacle for the NFC mobile payment developing in Finland. The research question is: What kinds of factors impact the NFC mobile payment development in Finland? What is the role of security issues as a factor in slowing down the adoption of NFC mobile payment?" The research study is set the scope in payment security sector.

2.3 Thesis Overview

This research consists of six chapters and starts with an introduction of the research problem. The thesis introduces NFC technology and mobile payment. In addition, the thesis describes the factors that affect the development of NFC mobile payment in Finland. Finally, the study focuses on security issues in mobile payment.

Chapter two discusses research methodology. It explores the research background and research question, and introduces the author's motivation for conducting the

study. Chapter two then proceeds to introduce the research method applied in this study and the various steps of the research process. Finally, this chapter prsents an overview of the study and introduces the data collection and analysis method.

Chapter three presents a literature review and discusses the relationship between the NFC technology and RFID (Radio Frequency Identification), the features of NFC mobile payment, the level of development, and the advantages and disadvantages of NFC mobile payment. Finally, this chapter discusses the security issues of NFC mobile payment as the main problem that should be solved.

Chapter four presents a case study, diecusses the research question in detail and demonstrates how the research problems are present in the case company. The case company is Kesko Group, which is one of the biggest trading sector companies in Finland. The author interviewed Kesko personnel about the current situation regarding NFC mobile payment, the potential security issues and how to improve the implementation of NFC mobile payment in the future. Moreover, the author conducted a small survey among the target group to data from the users' perspective.

Finally, the last chapter discusses the limitations, reliability and validity of the study. The final chapter also summarizes the results of the study and gives

suggestions for further study. The thesis overview is illustrated in figure 1.

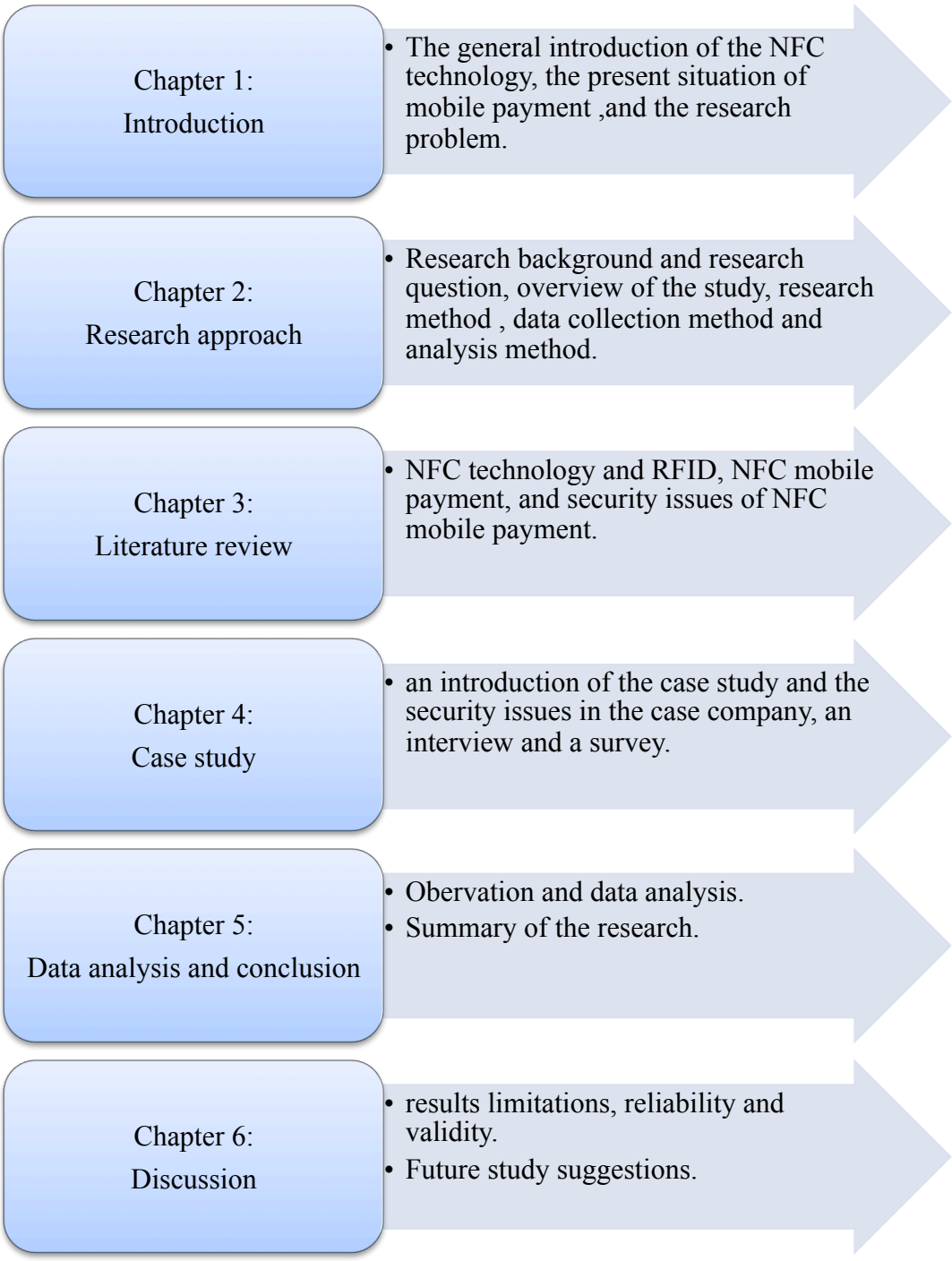


Figure 1: Thesis Overview

2.4 Research Methods

There are two ways of making conclusion: deductive reasoning and inductive reasoning. Deductive reasoning related to a researcher works from the more general data to the more specific data. (Shttleworth, 2008)

An inductive argument means the argument that is intended by the arguer merely to establish or increase the probability of its conclusion. Compared with the deductive argument, it allows the possibility of conclusion is false. (IEP, 2010)

This research takes inductive reasoning as the research approach. The author chooses the security issues as the main focus for the study. In addition, the author aims to find out if security issues impact the use of NFC mobile payment in Finland. It shows as the figure 2.

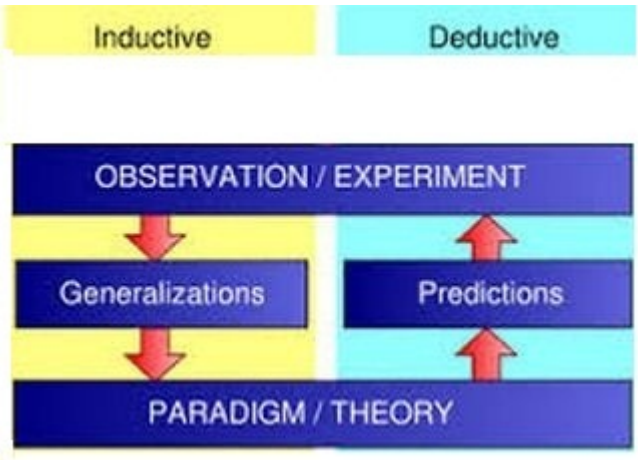


Figure 2 Inductive Reasoning and Deductive Reasoning

2.4.1 Qualitative Research Method

The author applies a qualitative research method, which provides the ability to understand a user's perspective on the NFC technology. In addition, a qualitative approach helps to examine business needs and to illustrate what kinds of difficulties are currently preventing the development of the NFC technology.

The qualitative research method process is illustrated in figure 3.

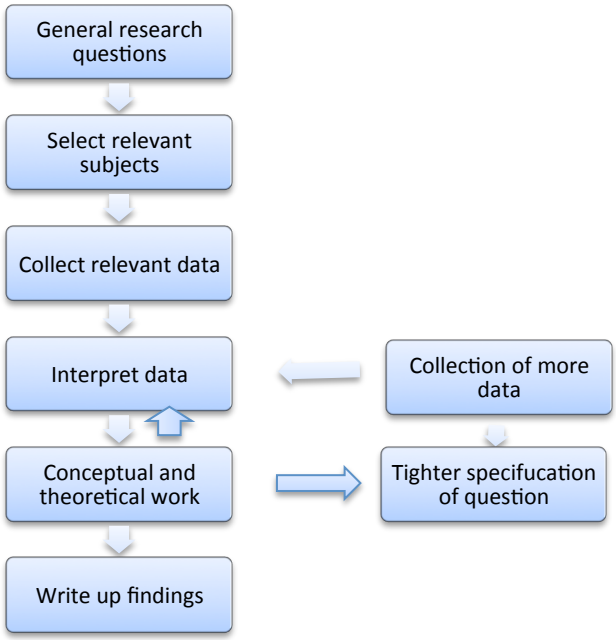


Figure 3 Qualitative research method study process

2.5 Research Framework

The study starts with a research background, literature review and the case study. The first key topic is NFC mobile payment. The NFC mobile payment system makes the payment process more efficient.

The second key topic is security issues. Security issues might prevent the development of the NFC technology in the Finnish markets. The mobile payment system and the NFC mobile payment security life cycle are therefore discussed.

The third key topic is the interview conducted at the case company. The interview concerned security issues which were defined on the basis of the literature review part. The aim was to find out if security issues affect the development of NFC mobile payment in Finland. The research framework is displayed in figure 4.

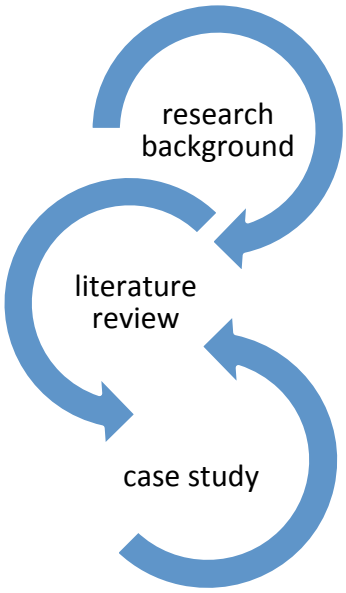


Figure 4 Research Framework

2.6 Data Collection Methods

"The method has a history that started in 1967 and there are many views on and variants of it. It is an evolving method, too, as researchers increasingly turn to it as a powerful tool in qualitative work." (Urquhart, 2013)

Qualitative research contains these characteristics: it seeks answers to a question, it systematically uses a predefined set of procedures to answer the question; it collects evidence; and it produces findings that were not determined in advance and produces findings that are applicable beyond the immediate boundaries of the study. Additionally, it seeks to understand a given research problem or topic from the perspectives of the local population it involves. Qualitative research is especially effective in obtaining culturally specific information about the values, opinions, behaviors, and social contexts of particular populations. (NATASHA MACK, 2005)

Participant observation is the appropriate data collection method for this study. In-depth interviews are optimal for collecting data on individuals 'personal histories, perspectives, and experiences. Focus groups are effective in eliciting data on the group and in generating broad overviews of issues of concern to the groups or subgroups represented. The author will gather all possible issues, which might affect the development of NFC mobile payment in the Finnish markets.

The interview conducted at the case company aims to find out if security issues affect the development of NFC mobile payment in Finland. The interviewee is the manager of the customer payment department at Kesko. The interview includes two parts: the situation of payment functins and the questions regarding NFC payment.

In addition to the interview, the author conducts a user survey. A total of 14 participants are invited to participate. The survey is created by the author and published on Facebook. All the participants are from the author's list of friends. In the survey the participants will be approached with following questions:

- What is your gender?
- What is your age range?
- Are you using a smart phone right now?
- Are you familiar with mobile phone payment?
- What kind of mobile payment are you familiar with?
- Are you willing to use mobile phone payment?
- What kind of factors should be taken into account when you are using mobile payment?
- Have you thought about the problems you might face when using a mobile payment system?
- Do you preferred to use mobile payment or bank card payment?

2.7 Data Analysis Methods

The data will be analysed after the author has found out the general difficulties related to the NFC technology. This will be discussed in the theoretical section of

the thesis. Moreover, after studying the features of the NFC technology, its current level of development and its development worldwide, the author will again apply data analysis. Finaly, the author will apply data analysis after making the interview and the survey.

3 LITERATURE REVIEW

3.1 NFC Technology

Near Field Communication (NFC) is a standards-based short-range wireless connectivity technology; it makes life easier and more convenient for consumers around the world. It is simpler to make transactions, exchange digital content, and connect electronic devices with a touch. (Forum, 2014) The main applications showed as follow (figure 5):

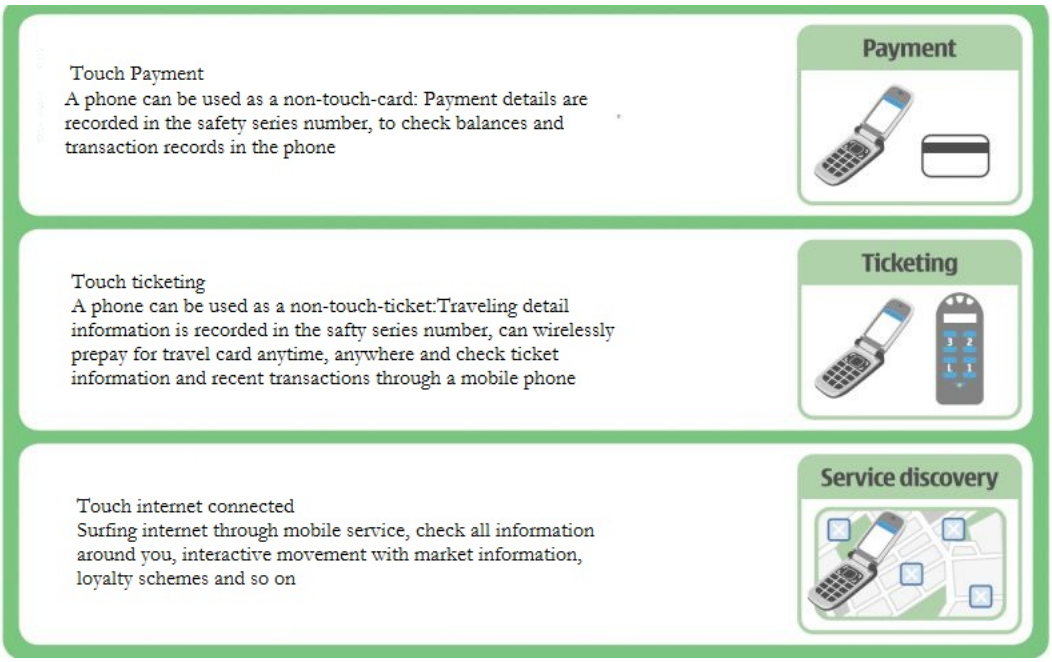


Figure 5 the Related Applications of NFC

NFC is a wireless connection technology, by Philips, Sony and Nokia have jointly developed, and the establishment of NFC Forum in 2004, is responsible for the near field communication and technology promotion agreements and other matters.

In the early development, NFC technology is based on RFID systems (Radio Frequency Identification) coupled with the identification induction and interconnection technologies evolved, and are compatible with existing contactless smart card technology. Its operating frequency is 13.56 MHz, the

effective transmission distance is between 10 ~ 20 cm, the transmission rate can be as basic 106,212,424 Kbits / seconds. In the mode of operation is different from RFID, not only "read" mode, but you can have a "write" mode. In every case, it able to be combined with NFC technology product like TV, digital cameras, stereos, cell phones, etc. and allowing more diversified applications.

3.1.1 NFC Standards

At present, the main technical standards of NFC, as NFCIP-1 (ECMA 340, ISO / IEC 18092), NFCIP-2 (ECMA 352, ISO / IEC 21481), NFC-WI (ECMA 373, ISO / IEC 28361), etc., have been verified by ISO / IEC and ECMA certification. (ECMA International, 2013)

NFCIP-1 International Standard is the most important part of the NFC technology, including the development of relevant details and other interface and agreements. The NFC device operates a radio frequency carrier in the Radio frequency field (RF field) is 13.56 MHz Bit coded messages transmitted using Manchester code, shown in Figure 6. Communication mode is divided into Passive Mode with Active Mode (figure 7). Bit rate transmitted by the communication mode to divide, in the passive mode for 106 ~ 424 Kbps, in active mode for 106 ~ 6780 Kbps. Although the bit rate is up to 6780 Kbps, the main market is still 106, 212, 424Kbps.

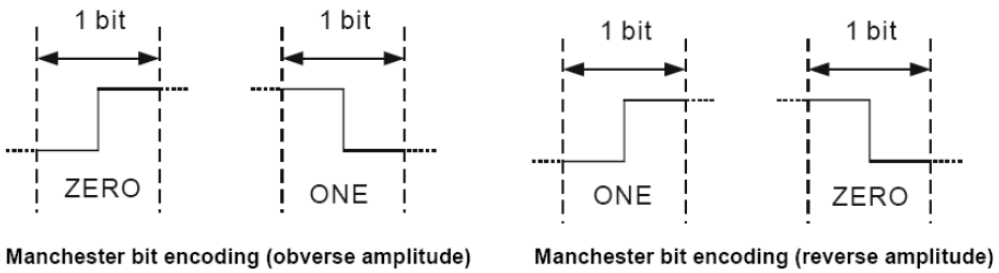


Figure 6 Manchester Code for NFC (Poole)

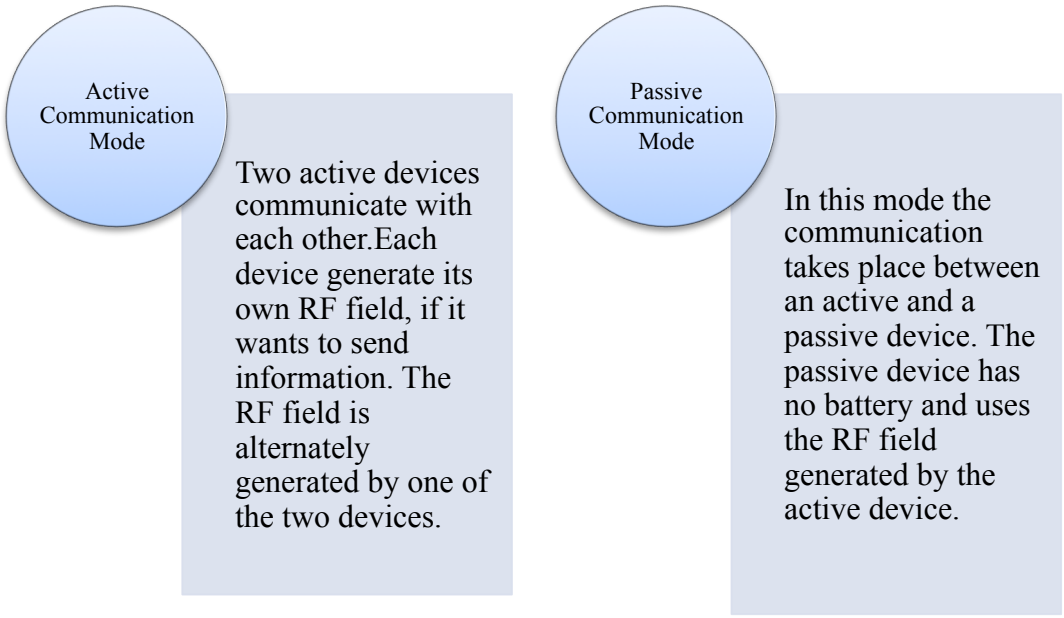


Figure 7 Communication configurations

As a bridging technology between devices, the biggest advantage of NFC technology lies in the use of automation and user-friendly operation, as is the use of RFID mode, simply a "Touch" action, depending on the application scenario with confirmation of the user, which can complete the entire application service processes. Compared to RFID, Near Field Communication technology can take the initiative to write and send messages, so that the overall use of the higher degrees of freedom.

3.2 RFID Technology

Radio Frequency Identification (RFID) considers as the radio transmissions which containing some type of identifying information. (Lindstrom, et al., Novermber 2005)

The basic operating principles of RFID technology is the signal to be transmitted into the electromagnetic waves, and the receiver can identify the signal source and read the information when it receiving the signals. The principle is illustrated in figure 8. There are three components as follow:

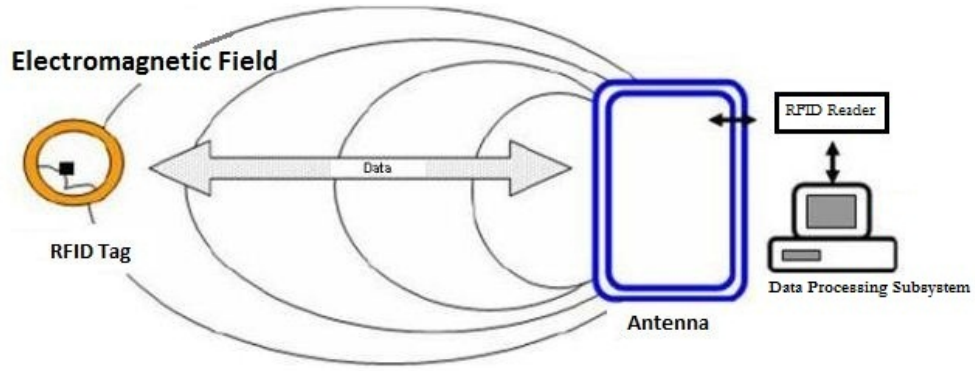


Figure 8 the principle of RFID

RFID Tag includes an integrated circuit (IC) attached to an antenna, usually a small coil of wires, plus some protective packaging. It can be divided into three types, passive tags, semi-passive tag and active tag. Passive tag has no internal power supply, the working distance is shorter, but the price is relatively low; the semi-passive tag has a small battery inside which can provide the power to drive IC and make the operation more efficient than passive tag; the active tag has an active internal power which can make it works in a longer distance and owns a larger memory.

RFID Reader consists of the antenna, a wireless transceiver and decoder. RFID reader sends the signal to the surrounding periodically to detect whether a label exists. Once it receives the return signal, that signal will be decoded and sent to the back-end system for processing.

The Data Processing Subsystem responsible for storing and managing data. It provides a method of processing information corresponding to the information for different applications.

RFID operating frequency can be roughly divided into three regions; LF (Low Frequency), HF (High Frequency) and UHF (Ultra-high Frequency). The main difference is about the transmission distance. The higher frequency the higher rate and father distance. But the relative increase in the manufacturing cost will be followed.

Low Frequency: 125 ~ 134.2 kHz or 140 ~ 148.5 kHz

High Frequency: 13.56 MHz

Ultra-High Frequency: 868 ~ 928 MHz

3.3 Comparison of NFC and RFID

RFID and NFC are the two popular key words at the moment; both are belonging to the Tagging technology. NFC is developed from RFID, and both are based on signal transferring conception between two objects in a near geographical position as essentially, NFC and RFID do not existed any big differences each other.

RFID is a non-contact identification technology, divided into two kinds of active and passive. The main works, RFID readers emit radio frequency, through the electronic tag coil generates a signal, the reader reads the information and decode, complete the identification process. Typically, active tags can also take the initiative to send a signal. RFID system consists of Reader and a Transponder.

NFC applications as one of majority technology applied on mobile phones in recent years, it can provide function that exchange interactive information and completes the corresponding transactions and other purposes when two NFC devices within a relatively close distance near each other. The biggest feature for the NFC is that reader and transponder integrated into one single chip.

NFC technology to increase the point to point communication function, user can quickly create P2P (point to point) wireless communications (shows in figure 9) between Bluetooth devices, NFC devices communicate with each other to find and establish connections. P2P communication is paralleled relationship, while the RFID is a master-slave relationship between the two communication sides.

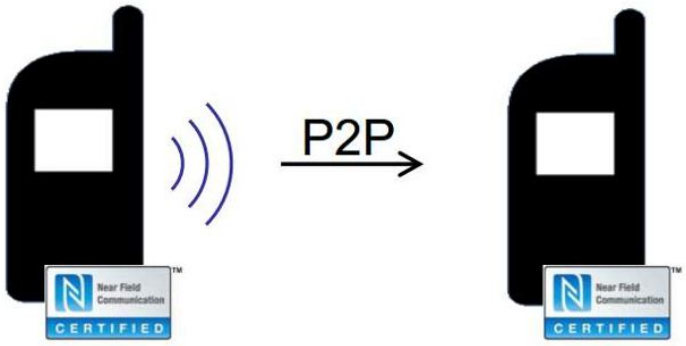


Figure 9 NFC Point 2 Point Communication

Because at 13.56MHz, NFC technology is compatible with existing smart cards also work with non-contact, so a lot of producers and related organizations all support NFC, but RFID has many standards and very difficult to unify them all, only in special industry with special needs, the use of appropriate technical standards. In the figure 10 is the Comparison between NFC and RFID from different factors. Through this comparison, NFC technique is more capable for personal application just with a simple touch.

	NFC	RFID
Set –up time	<0.1ms	<0.1ms
Range	Up to 10cm	Up to 3m
Usability	Human centric Easy, intuitive, fast	Item centric Easy
Selectivity	High, given, security	Partly given
Use cases	Pay, get access, share, initiate service, easy set up	Item tracking
Consumer experience	Touch, wave, simply connect	Get information

Figure 10 NFC Comparing With RFID (Forum, 2008)

3.4 NFC Around the World

Along with the development of wireless communication technology, near field communication technology at the same time get more and more attention, after the technology through the international standard standardization verified, many countries of the world were actively starting application of the test of the related near field communication, and to promote its technology applications.

3.4.1 NFC in China

In China, Since August 2007 Nokia 6131 NFC mobile phone has been sold to Guangzhou, Xiamen, Beijing and other cities, only if a mobile phone download a specific application, can be used to do the payment after prepaying the credit into the card when taking public transportation, or in some special store complete the payment transaction, in addition, the people's bank of China (PBOC), China mobile and the Smart Catch implemented plans in mainland China city like Chongqing, launching NFC integration SIM card, embedded in a cell phone as a parking payment functions.

3.4.2 NFC in United States

New York launched a four-month test, which called “NYC Mobile Trial” in 2007. It included consumption in special institutions, access to information from smart posters and buy subway tickets.

A Philips Arena in Atlanta of US had a test, which is using Nokia 3220 Smart phone. Football fans can shop with the Nokia 3220 in the Arena special store, and also download pictures and videos from smart poster posted in Arena. (Mokhoff, 2005)

3.4.3 NFC in Germany

160 people from the city of the Hanau in Germany were invited to a 10 months test which using the public transportation with Nokia 3220 phone charged, and this test get an over 90 percentage positive answer of the convenience, and this test is organized by Nokia, Philips, and RMV(Rhein-Main Verkehrsverbund, German Public Network Operator). (Nokia, 2006)

3.4.4 NFC in Finland

The SmartTouch is developed by Oulu Innovation agency, which lunched a six years plan in 2007 focus on discovering its untapped IT potential. The smart touch analyzes the use of touch-based user interaction to demonstrate new and innovative mobile services. (Incisive Business Media (IP) Limited, 2008)

In the year 2009, forty members of staff from payments provider Nets Oy, Sodexo and Visa Europe have been issued with NFC mobile trial, they can use to make payments at merchants equipped to handle contactless payments in Helsinki and at Nets' offices. (Clark, 2009)

In middle of 2011, Finnish start-up 6Starz has disclosed a new social networking service which enable bar, restaurants and nightclubs to communicate with regular customers based on the NFC technique. Customer can make the check in by touch a tag or gets another user's contact information by phone touching. (Clark, 2011)

3.5 Smartphone Ownership

In 2014, approximately two thirds (65%) of all Finish people have a smartphone. According to the smartphone ownership age group, with the biggest rise in penetration among is the 18-24 year olds group. (Figure 11)

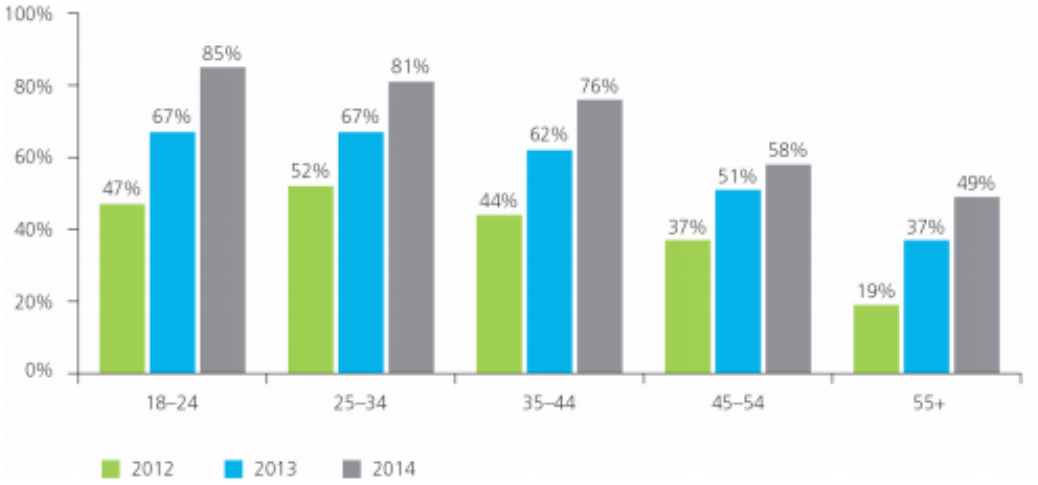


Figure 11 Smartphone ownership in Finland (Deloitte & Touche Oy, 2014)

3.6 NFC Mobile Payment

Mobile payments can use a number of different technologies to make a transaction. Remote payments typically rely on text messaging, a mobile web browser, or a mobile application. Proximity payments rely on either bar codes or a contactless interface to enable the chip payment technology, such as NFC technology based mobile phones, contactless stickers, tags, or fobs. (Alliance, 2011)

NFC made its way into Android in 2010 with the release of Gingerbread, and the first NFC-enabled Android phone was Samsung Nexus S in Figure 12. The first NFC implementation was pretty limited, although it was expended with the release of 2.3.3 a few months later. (Bergman, 2013)

By 2.3.3 version, Android supported reading and writing to a variety of NFC tag formats. Android 2.3.4 contains card emulation mode, which allows the mobile device to emulate an NFC smartcard so another NFC reader can read data from the secure element contained inside the device. (Bergman, 2013)

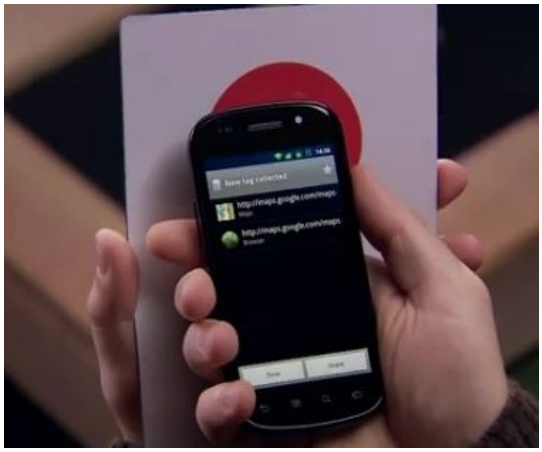


Figure 12 Samsung Nexus S (Thitwam, 2011)

”Local payment is where the buyer and vendor conduct a transaction face to face.” The server wallet concept where a user’s payment method, such as credit card number, is stored on a wallet server operated by a bank is the preferred architecture for remote payments. (Dezoysa, 2001)

3.6.1 Generic Application Service Framework

In this framework it divided into three layers, which are application layer, UNFCS (Universal Near Field Communication Service) core layer and the NFC interface layer. The application layer provides the space for running the service program. UNFCS core layer is the physical layer which consists of several components to providing the necessary services related to the NFC application. The framework shows in figure 13.

- Application Layer:
  This layer related to all the application service programs which are placed in this layer. The application service design in this layer based on the application framework, it focuses on writing for different application service requirements which includes functions, control command and message content. Once enable the application in this layer, are required to register the underlying Application, it can be forwarded to the application which responsible handling of the message only when the NFC device receives the data.
- UNFCS Core Layer:

The main purpose of layer is to manage, resolve and storage near field communications-related information and Records, which includes eight components, namely Dispatcher, Application Register, Record Manager, Record Parser, Network Connecter, NFC Controller, App Name Repository and NFC Repository. All of them supply various capabilities separately for Near Field Communication applications requirement, but also they can perform alone a simple application of NFC services.

- Interface Layer:

  This layer belongs near field communication physical layer part, is the forefront of the near-field communication device, the actual link with other devices (non-contact) part. There are four basic hardware layer States, respectively, transmit, receive, read and detect idle.

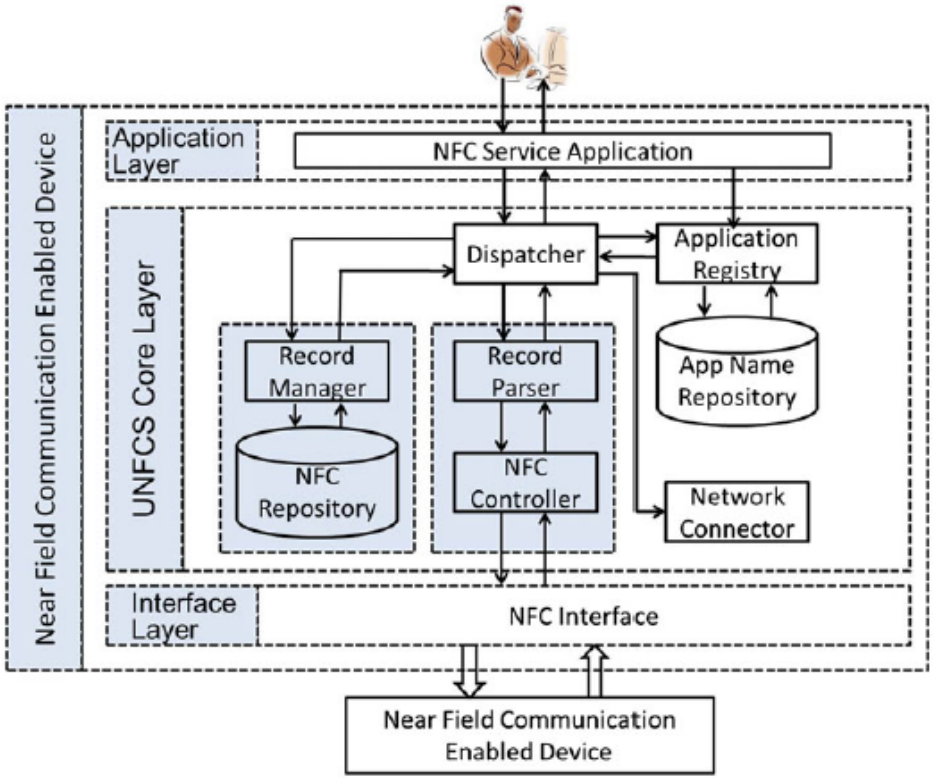


Figure 13 Universal NFC Service Framework (Hung, 2011)

3.6.2 Standandization Issue of NFC Mobile Payment

Although NFC mobile payment portable feature gives the owner the convenience of use, however because of the characteristics of passive components on the external connection do not have actively connected features, each time using it have to be in a particular place are compatible device in order to accommodate use to make such electronic money package not fully perform their function on application.

3.6.3 Cost issue of NFC Mobile Payment

Mobile contactless payment provides a means to add value to their commercial offerings with new services that will, potentially, allow them to increase their average revenue per user thanks to new revenue that could come from different sources, such as transaction fees, renting, space on the handset or SIM card, data traffic (mainly from over the air [OTA] downloads), managing service providers' applications, and providing financial service. (ISACA, 2011)

NFC Mobile payment application is incorporated on a single chip proximity readers, cards and point-of inductive function, can be identified and data exchange with compatible devices within a short distance. NFC technology is currently the most practical in Japan and Korea, user simply holding NFC-enabled mobile phone can act as a bus card, subway ticket also be used to pay even as a credit card at the shopping malls.

In 2006, China has some cities (such as Beijing, Xiamen) also launched NFC technology-related trials include public payments, shopping malls payments, but then have NFC-enabled phones high price, coupled with the lack of such first Business supports the tripartite cooperation, mobile NFC payment technology then fizzled, carriers are now pushing the "SIM phone payment" is actually based on NFC technology, but the early independence of NFC modules make it smaller. (zol.com.cn, 2014) But the implementation of NFC technology the key point is that businesses need to purchase specialized NFC devices, so this increases the cost of business, which is still an important reason for failure in the NFC domestic popularity.

3.7 Competitor issue of NFC Mobile Payment

At the same time, 3G network gradually rise, so mobile payment appeared another new form: SMS Internet payments. This mobile payment relying on the computer side of the Internet, users at the computer operated by online banking, and will pay the verification code and other information sent to bind the phone and the user clicks the link in the message through the Internet browser to complete the next step is to confirm the payment.

This mobile payment safety factor is relatively high, as is the need for a password, the phone at the same time meet. But it does not completely counted as separate mobile payment, because its trading approach is the need to use computers, the amount of the transaction is done at the computer, and mobile terminal to play a more just like "confirm the payment" role.

3.7.1 La Ka La Terminal POS Mobile Payment

In 2013 There is another new emerging payment which so called La Ka La mobile payment. With a mini card reader and a La Ka La APP, user’s mobile phone will in to payment terminal machine. It can be used to charge the credit card, recharge phone and other operations. It will solve the problem the coverage of a number of POS terminals.

Figure 14La ka la Pos terminal mobile payment (2012)

La Ka La POS (figure 14) machine operating is quite the same as the normal POS terminal: Users select the item to pay and the mini- card is inserted into the phone's 3.5 mm headphone earpiece, then brush bank card, enter the password on the phone and press confirm.

First of all, user has to purchase a card reader, which is named mini La Ka La, installed the application and make the registration. Because it compacts users not only can use it at home as a Pos machine also easy for users to carry it using outside. Moreover, it is saving the paper resources as the payment receipt.

3.7.2 Ali Pay App Mobile Payment

Ali pay wallet (figure 15) is a mobile terminal software APP which launched by Alibaba Alipay, this software is the first computer terminal with Alipay most features, such as the pay back the credit cards, normal payment and transfers, etc. And it truly reflects mobile payment functions play the part of the essence of the word "wallet".

For example, the current Beijing taxi can support Alipay payment, the car has a two-dimensional code card, the two-dimensional code is a taxi driver Alipay account two-dimensional code on the card, the passenger simply turn Alipay wallet "sweep the "function, then scan two-dimensional code on the card, and then enter the amount of travel expenses and the user's password to complete the payment of the fare paid, followed by Alipay will separately for driver and passenger mobile phone text messaging to confirm this the transaction amount of times, parties to the transaction.

Figure 15Ail Pay mobile payments (2012)

3.8 Security Issues of NFC Mobile Payment

Many merchants seek innovative ways to attract customers and improve the shopping experience. The ever-expanding capabilities of mobile devices such as

smart phones or tablets now includes payment acceptance. (PCI, August 2014) NFC tags are beginning to see more use in the life, with signs in malls, airports, and even bus stops asking users to tap their phones for additional information. (Bergman, 2013) Along with the increased convenience at the Point of Sale, mobile payment acceptance can also bring new risks to the security of cardholder data. (PCI, August 2014)

Different devices handle different type of NFC tags. For instance, Android Gingerbread devices that support NFC open the Tags application when a tag is read. Android 4.0 (Ice Cream Sandwich) and Android 4.1(Jelly Bean) devices directly open a supported application to handle the tag containing a URL is opened by the Browser application; otherwise, the tag is opened with the tags application. NFC tags bring a new attack surface for Android devices, and some interesting attacks have already surfaced. (Bergman, 2013)

If an NFC tag contained a URL pointing to a malicious site, a user who scanned this tag would find that his or her device had been compromised. NFC tags are cheap to buy online and can be written to with an NFC-enable phone. (Bergman, 2013)

There is two possible NFC-based attacks are mentioned as: the attacker could make convincing-looking posters and attach the malicious NFC tags to them; the attacker can overwrite a tag if the tag was not properly write-protected. (Bergman, 2013)

The first type of attacker either removes a real NFC tag or replaces it with his or her own, or simply places the malicious tag over the original. An attacker increases the chances that his or her tag will be read by putting the malicious tag on a legitimate advertisement. Second type of attacker allows anyone with an NFC-enabled phone and NFC tag-writing software, which is available in a Google Play store to write their own data on an existing tag. (Bergman, 2013)

3.8.1 Process of Bank Centric NFC Mobile Payment

This is the process of bank centric NFC mobile payment in figure 16.

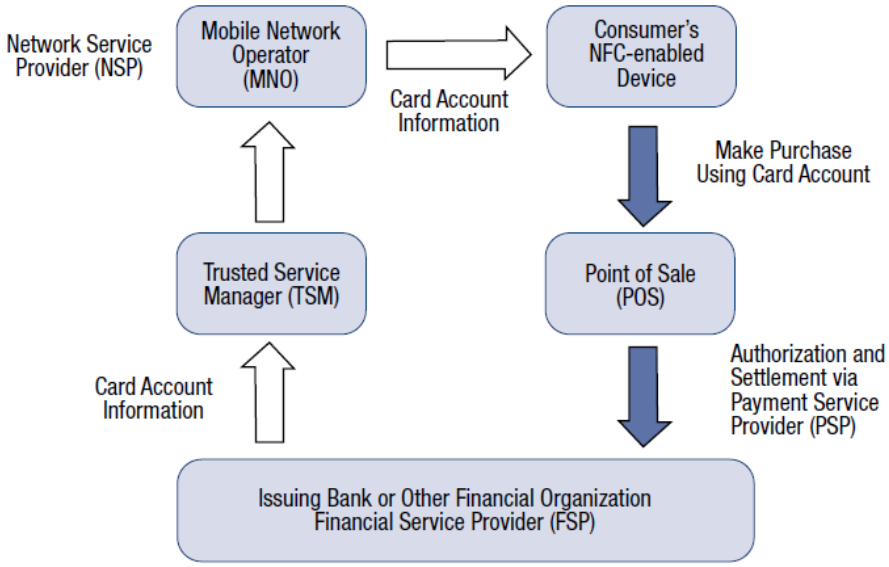


Figure 16process of bank centric NFC mobile payment

From the diagram, different stakeholders were displayed in the bank-centric mobile payment life cycle. It also illustrates the information concerning flow.

The Solid arrows show payment-related transactions, from the NFC consumer side to the POS machine. The outlined arrows indicate actions related to the personalization of the application. Which are internal and external sessions accused during them the NFC mobile payment.

3.9 Decryption of NFC Application

Rising Software company marketing Director Mr. Tang indicates that NFC technology supports user transfers, payments, and other identity information is automatically read operation, the completion of such operations, the card without direct contact with the phone, as long as within a certain distance, the phone can Taking reads the card information. Therefore, in the bus, subway, shopping malls and other crowded public places, the cardholder might lose the import personal identity information or property information by malicious software.

Rising cloud security system had intercepted an example NFC virus; it can rewrite data in the IC card during IC card communicates with phone, in order to achieve the purpose of tampering or destruction of the IC card. Currently, the virus technology is not yet mature, and behavior is relatively simple. However, the development of the huge space NFC payments in the future, a hacker is likely to increase the NFC virus research efforts, then, using a virus to steal bank account information or user privacy information.

Figure 17Depcryption of NFC Application (Chris, 2014)

In fact, in 2012 two American researchers have found the NFC pay serious security vulnerabilities, they decryption the NFC traffic card and be able to take the metro free of charge. News from UK reported that the NFC decryption phone just gently swept the bankcard, the information form the bankcard can be completed reading by the phone within a few seconds. After reading the information can be used on online shopping, it can also be used to answer the security question set by the bank. According to statistics, nearly 30 million UK contactless bankcards are facing such a threat.

Rising security report also noted that attackers just need some specialized equipment the card balances or other information would be tampered with or copy.

Therefore, the chip bankcard using become universally, it will bring more possibility of using tamper technology for large financial crim.

3.10 Analysis Security Issue of NFC Payment

In early June of 2013, British news detonated industry fraudulent discussion, according to British media reports, as long as the phone gently swept away at close range, user can read the complete basic information on the bank card within a few seconds. After reading the information can be used in online shopping, but also can be used to answer the security questions set by the bank.

According to statistics, nearly 30 million UK contactless bankcards are suffering from such threats. But in fact, if a business which does the bank card personalization or a bank when writing personal banking information to the card including the corresponding encrypted storage of sensitive information, even if the mobile terminal is able to read the corresponding bank card information, it is only limited to the number. For additional information needed to complete a transaction, such as ID number, expiration date, CVN (card verification number) etc. still unable to obtain.

These information will be read not actually enough to complete a transaction. Different bank card issuers, disclosure of information that can be read different, and a professional person from mobile payment field said: "Like A bank card with NFC software to read, only read card information; but B bank cards also read the ID number, which shows B bank card security is weaker than A Bank.

The researchers revealed that, NFC card itself has a read-only protection, but transportation system is not set up the security protection layer, which allows the crackers have a chance. The crack experiment for the London Underground will have no effect, because the local transportation system for NFC card uses a more advanced encryption methods.

4 CASE STUDY

In this chapter, the author gives the further exposition about the NFC mobile payment from both case company and potential customers' views. The main core is focus on the security issue.

4.1 Case Description

The NFC technology is the most popular fundamental technology for the contactless payment into the market. In Finland the contactless payment base on NFC functionality arriving at KESKO (K-Group) from 2012. Kesko group is a highly valued listed trading sector company. The Operations include the food, home and speciality goods, building and home improvement, and car and machinery trades. Author will take Kesko group as case company to make interview so that make a clearly view of payment terms situation in Finland, as Kesko group is one of the biggest company in Finland.

Kesko manages retails store chains that are valued by customer, and efficiently produces services for retails store chain's purchasing, logistics, network development. There are around 2,000 stores of Kesko in Nordic countries. K-Plussa's contactless cash card is the best NFC technology based service in Finland in 2012. The recognition was announced at the Digital Media Day 2012 event in Helsinki on 7 November 2012. (Kesko, 2012)

Figure 18 K-pluss card

However after almost 3 year developing, the contactless payment just constrained by a small number of customers who has the contactless K-Pluss card with small purchases which below 25 euros. About the NFC mobile payment application still not been appropriated use. KESKO group Ltd is selected as the case company for the author to make the interview about the situations of NFC payment and NFC mobile payment. The author would like to make an interview to the manager who is in charge of the customer payment department so that make sure the usage rate of NFC payment and the security influence.

Figure 19 NFC payment with k-pluss card

4.2 Interview Case Company

The author has made the interview to the customer payment department manager with the NFC payment issue. It is aim to figure our weather there is any security issue exist and obstruct NFC payment in this consuming market.

Here is the detailed content of the interview as follow:

1. What are the main payment terms in Kesko stores during the past 5 years?
   The main payment terms have been
   - **cash**
   - **card payment (debit bigger than credit)**
   - **bill in hardware stores**

2. Does KESKO stores' POS terminal accept NFC mobile payment?
   Kesko stores use NFC payment in the payment terminal with POS-terminals but only with payment cards. We don't have any mobile payment systems yet.

3. Please indicate your store' **timeline** of implementing NFC mobile payment term if answer of question 2's is positive.
   Kesko has started NFC payment with contactless card and payment terminals in our K-rauta an Rautia stores in December 2013. This year Kesko has launched contactless payment in our other stores.

   We don't have exactly timetable when we started payment with mobile but target maybe end of year 2015 or during 2016.

   It is very important to us learn first to use contactless payment and also teach also our customers to use contactless payment cards in checkout services.

4. How much the acceptance rate from customers who were using the NFC mobile payment until now?

5. Are there any limitations for NFC mobile payment in KESKO stores (e.g. amount of payment and so on)?
6. Can you give me an example of payment failure if the acceptance rate figure shows increased?
7. How do you think about security issue becoming the effect to using NFC Mobile as payment term among your customers comparing with technical knowledge, using habit, convenience and so on?

   Kesko follow all PCI enactment very carefully so security will not be barrier to use new technology. But sure customers have to learn new habits and it will take some time. Payment card are so easy to use that it will be hard to win them as a payment tool.

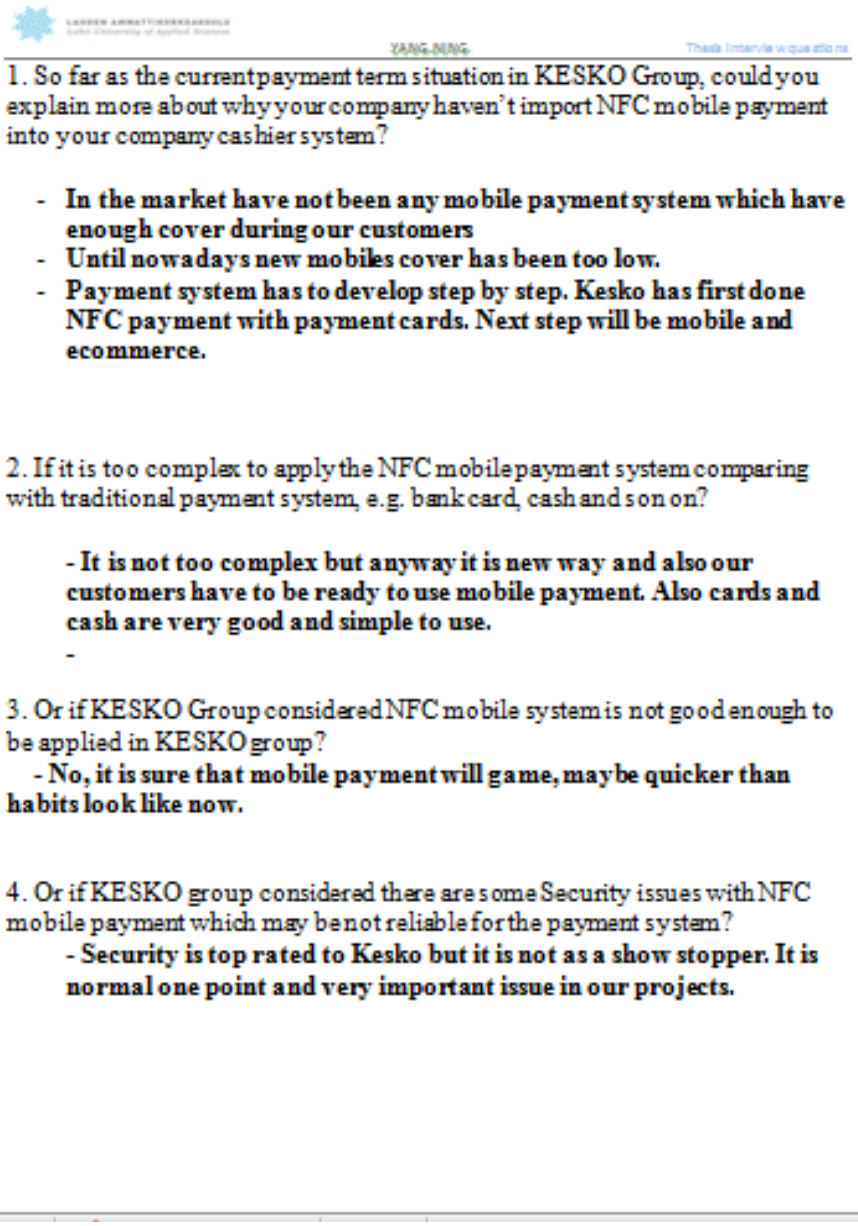
8. NFC mobile payment users percentage vs traditional payment such as cash, bank card, others in 2013

9. How is the growth rate of NFC mobile payment users from the beginning until now?

10. Customer feedback about NFC mobile payment terminal reader.(Any complains)

11. Does any complain about the security issues?

12. Can NFC mobile payment possibly considered to be one of the future main payment functions in your store?



YANG NING

1. So far as the current payment term situation in KESKO Group, could you explain more about why your company haven't import NFC mobile payment into your company cashier system?

- **In the market have not been any mobile payment system which have enough cover during our customers**
- **Until nowadays new mobiles cover has been too low.**
- **Payment system has to develop step by step. Kesko has first done NFC payment with payment cards. Next step will be mobile and ecommerce.**

2. If it is too complex to apply the NFC mobile payment system comparing with traditional payment system, e.g. bank card, cash and son on?

- It is not too complex but anyway it is new way and also our customers have to be ready to use mobile payment. Also cards and cash are very good and simple to use.

-

3. Or if KESKO Group considered NFC mobile system is not good enough to be applied in KESKO group?

- No, it is sure that mobile payment will game, maybe quicker than habits look like now.

4. Or if KESKO group considered there are some Security issues with NFC mobile payment which may be not reliable for the payment system?

- Security is top rated to Kesko but it is not as a show stopper. It is normal one point and very important issue in our projects.

First of all, author would like to make sure the main payment term in this case company. Cash and debit card payment are the two main payment terms. From the interview with the case company, NFC payment is just works with their member ship card and the limitation is 25 euros as the highest. Unfortunately, there has no POS machine for NFC mobile payment yet.

"In the market have not been any mobile payment systems which have enough cover our customer" proposed by the customer payment department manager. The mobile payment system didn't been applied in the market. Interviewer also brings the possible factor, which the percentage of new mobile (smart phone with

Contactless payment) was not significantly. For the new technology, step by step of the development is demanded in kesko group.

Comparation of the NFC mobile payment and traditional card payment shows card payment is simple and useful, which lateral depict the difficulties for NFC mobile payment to replace the recent main payment term in Kesko group.

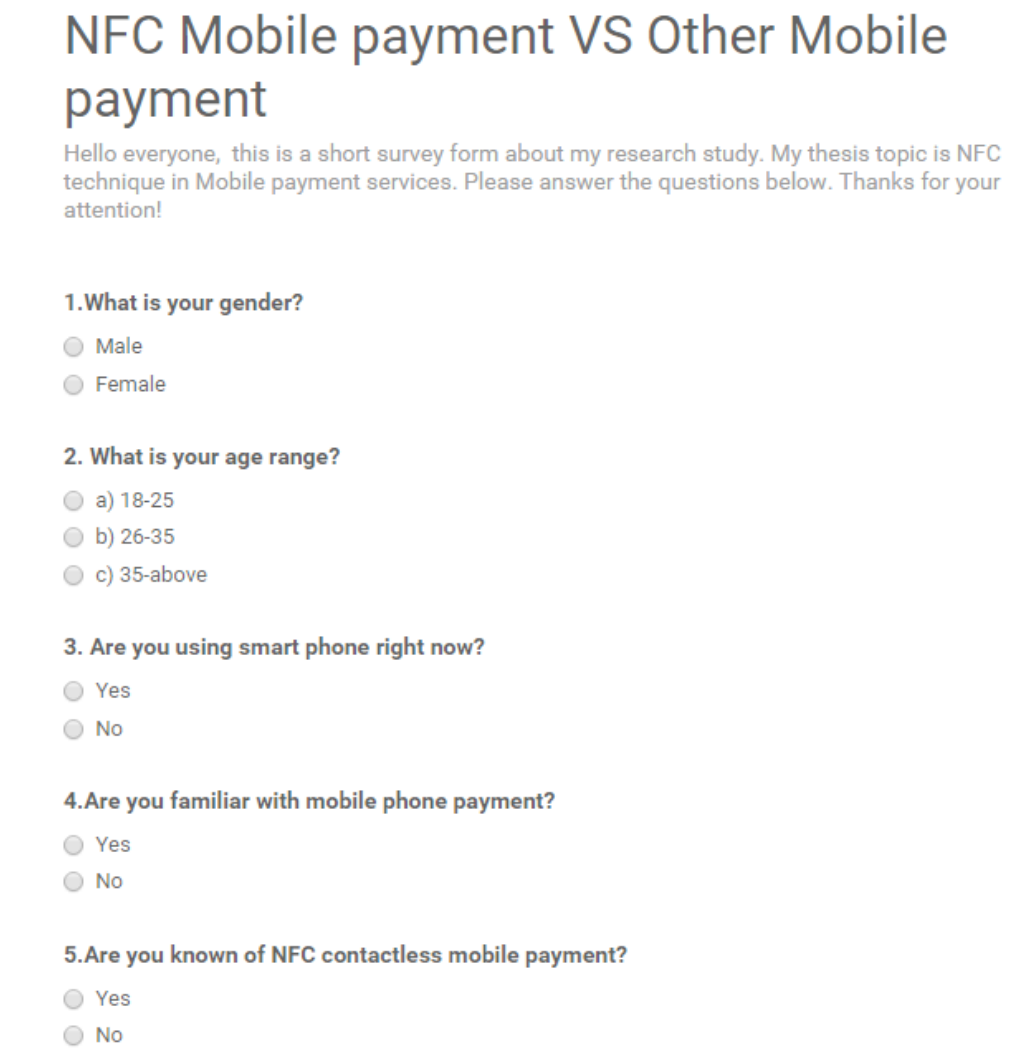
According to the recent situation of the consuming market, author gave these questions: “why such a big market didn’t apply NFC mobile payment term yet? Is there any security issues prevent this technique happens in this market? ” The answer is: “if there has any security issues, it will be fixed before it been applied in the real market”. Regarding the security issues Kesko group follows all PCI (payment card industry) enactment very carefully.

From the company side, security issue seems not the biggest issue to prevent the development in the Finnish market. The factors can be: a) NFC mobile payment system not in used wildly in people consuming life; b) Smart phone using percentage is not numerous; c) traditional payment term is simple and conversance.

A survey for the user side is essential to observe whether the security is the main obstacle for using the NFC mobile payment of the user sides.

4.3 Questionnaire Survey

The questionnaire is focus on the user’s acknowledgment of NFC mobile payment and the satisfaction of NFC mobile payment and other payment functions. A total number of 14 interviewees will be invited to participate in the survey interview. In the interview, the interviewees will be approached with the following questions:



NFC Mobile payment VS Other Mobile payment

Hello everyone, this is a short survey form about my research study. My thesis topic is NFC technique in Mobile payment services. Please answer the questions below. Thanks for your attention!

1.What is your gender?

- Male
- Female

2. What is your age range?

- a) 18-25
- b) 26-35
- c) 35-above

3. Are you using smart phone right now?

- Yes
- No

4.Are you familiar with mobile phone payment?

- Yes
- No

5.Are you known of NFC contactless mobile payment?

- Yes
- No

Figure 20 Questionnaire of NFC mobile payment

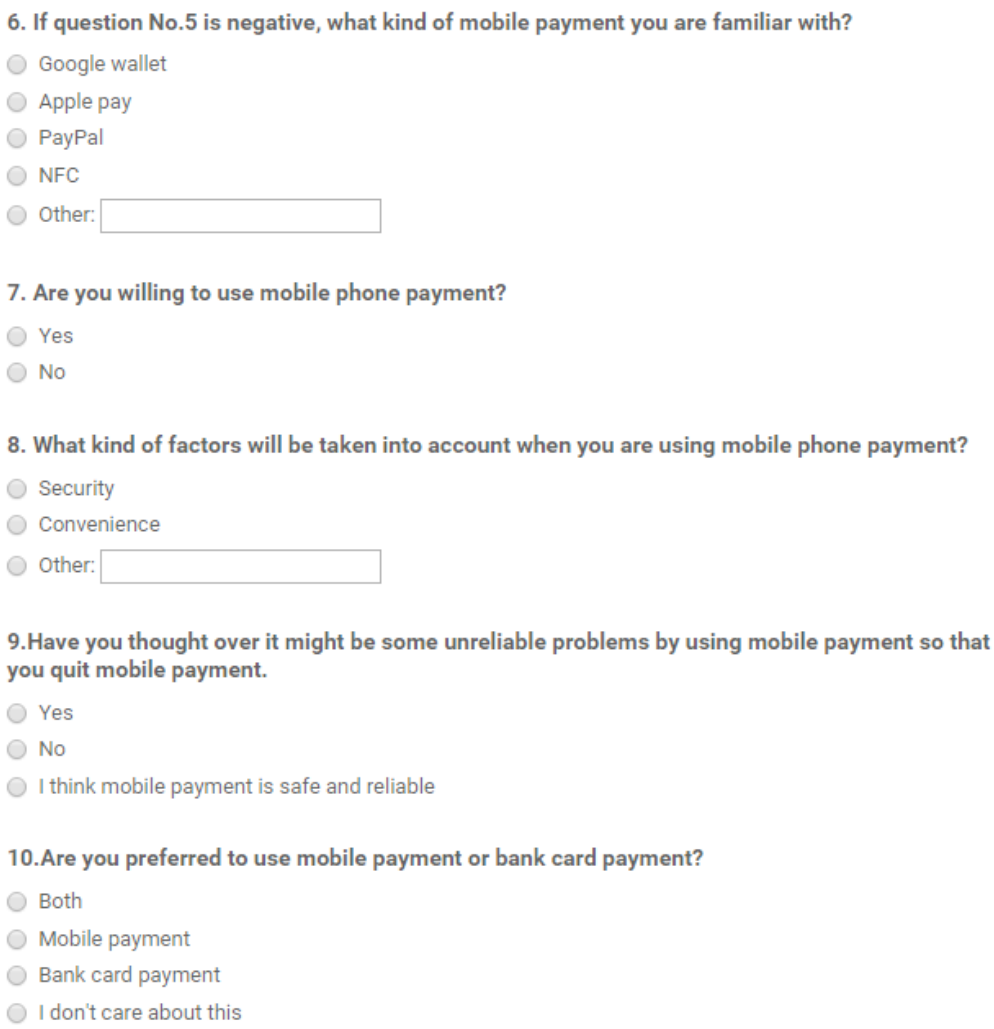


Figure 21 questionnaire of NFC mobile payment

The age range from 18 to 35 set as the target group for the survey. In the target group, 100% of them are using smart phone. 78.6% of the respondents are familiar with the mobile phone payment, 71.4% of the respondents know and willing to use the NFC contactless mobile payment. It can be seen that the cognition of NFC payment is remarkable for the smart phone users. (Figure 22)

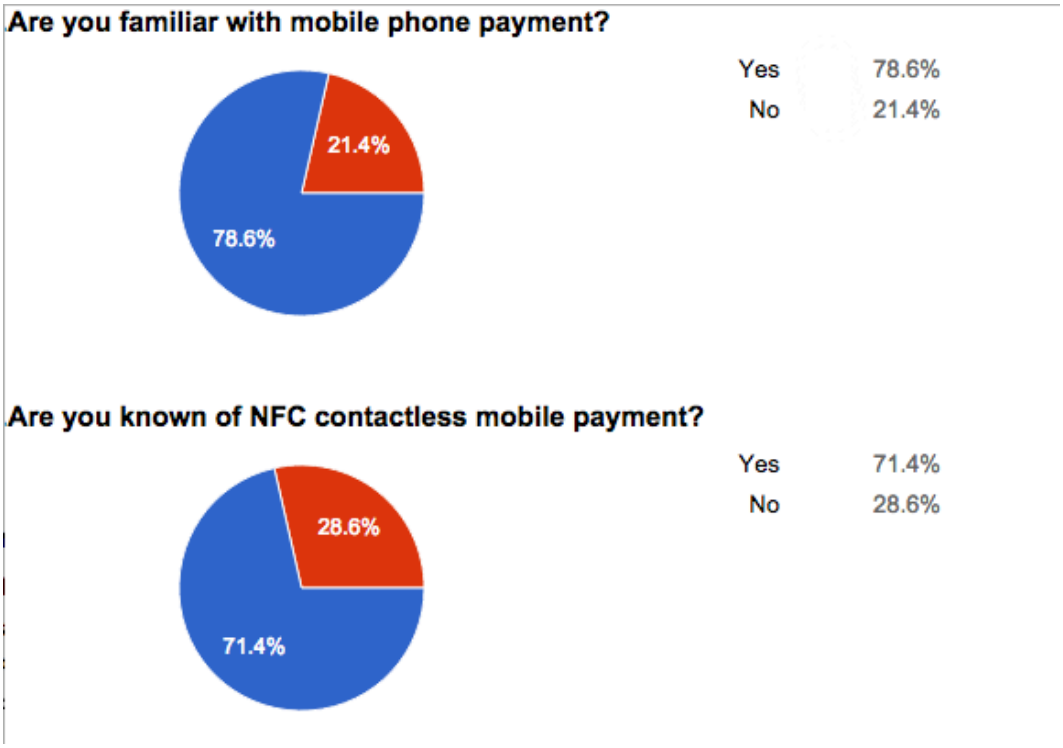


Figure 22 NFC mobile payment survey

Regarding the security issues, the potential users consider it as the possible factor, which will interrupt the idea of using NFC mobile payment. Furthermore, the comparison of NFC mobile payment and traditional card payment illustrate traditional card payment is their first choice. 50% feedback data shows they are willing to use traditional card payment, 35.7% of them choose both of the payment term, and 14.3% of them are not care about the payment term. 0% percent of the respondent willing to use mobile payment compare with the traditional card payment. (Figure 23)

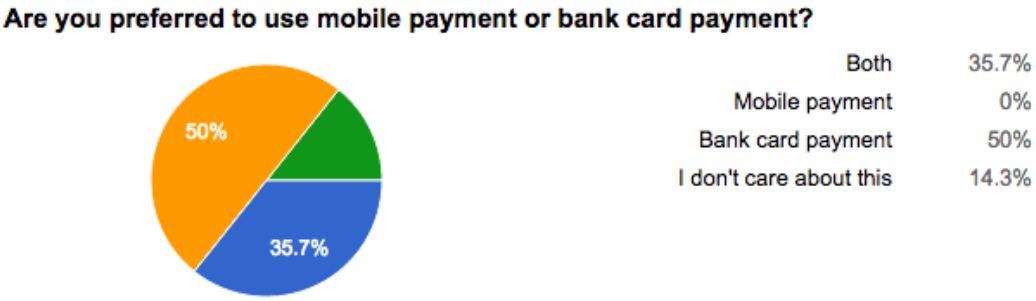


Figure 23 Comparation between NFC mobile payment and Tradition payment

5 DATA ANALYSIS AND CONCLUSION

The aim of the study was to find the possible issues (especially security issues) related to NFC mobile payment is not widespread in Finland. Author makes the theory research from the literature review chapter and found the potential factors affect the development of NFC mobile payment.

First of all, standardization issue limited the NFC payment only works with the payment terminal with NFC payment system; In Finland, the NFC mobile payment terminal is still not in used widespread. The only NFC payment is limited within 25euro with the bank card with the NFC chip.

Cost issue restricts the possible NFC mobile payment user in a smart phone holders' scope; from the literature review part, the statistic of smart phone ownership is illustrated that the NFC base devices are not in used widespread in Finland. Decryption, duplication and stealing are the possible security issues of the NFC mobile payment. These data are collected as internal research data from the literature review.

However, in the case company study we set these questions regarding the security issues into an interview and propose the result which is the possible security issues are resolved and avoided before the new technique applied in people's consuming life.

6 DISCUSSION

This study is based on the literature review and and an interview conducted in the case company interview and a target group survey. Decrypting the NFC mobile payment process is one of the possible security issues. However, base on the interview, there is a new technology in use that will be tested until it is reliable. The biggest competitor for the NFC mobile payment is people's payment habits. People are already satisfied with card payment, because it is already easy and simple.

6.1 Limitations

This study includes three limitations. First of all, NFC mobile payment terminals are rarely used, even though the NFC card payment and technology have been applied in Finland. Secondly, smart phone use is still in ~~a~~ limited in Finland. Finally, the numbers of the participants of the questionnaire survey and interview is another limitation for this study.

6.2 Reliability

This research study is using parallel forms reliability, which is, means the measure of reliability obtained by administering different versions of an assessment tool to the target group. Both research survey and interview make the similar reaction that is user is satisfied with the card payment term.

6.3 Validity

The research survey was taken place in the target age group which familiar with NFC technique. The interview of case company indicates the veridical situation of the payment functions in Finland.

6.4 Future Study

Regarding the suggestions about the future study of this topic, the author advises that safety and convenience are always part of NFC payment. A quick payment

transaction might lead to fraudulent conduct. However, security is obviously necessary to ensure. A security system not only includes mobile phones but other equipment, including peripheral devices, and process between devices, between the device and system information exchange.

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